

**Lieutenant General Larry J. Dodgen, U.S. Army**

**O**UR NATION'S SECURITY challenges are substantially more diverse and uncertain than they were just two decades ago. The ongoing Global War on Terrorism (GWOT), continued unrest and instability in the Middle East, and the effects of globalization accelerated by remarkable technological advancements illustrate the increasing complexity of our world.

Today, our Nation and Army are at war confronting a different type of enemy. Defeating this enemy and winning this war will be a protracted process. For the foreseeable future, the Army will likely be engaged in the GWOT and in support of our Nation's other commitments and international obligations. To meet these challenges, the Army must "remain relevant and ready by providing the Joint Force with essential capabilities to dominate across the full range of military operations."<sup>1</sup>

Exploiting the effective use of space, and its inextricable linkage to missile defense, is integral to supporting this strategic goal. As part of the Joint Force, the Army will leverage the synergy of space, land, sea, and air superiority and "in concert with other elements of national and international power, will conduct integrated, tempo-controlling actions in multiple domains concurrently to dominate any adversary, and help control any situation in support of strategic objectives."<sup>2</sup>

## **Leveraging Space for Warfighters**

Space-based systems and unhindered access to space are linked to America's national security and are increasingly critical to our economic well-being. Space operations have literally transformed military, civil, and commercial enterprises.

Similarly, military operations have moved from being supported by space assets to being space-enabled. Operation Desert Storm (ODS), often called the "first space war," demonstrated the value of this new medium as a combat multiplier. Nearly every aspect of ODS depended to some extent on support from space-based systems. The use of the Global Positioning System (GPS) and long-haul communications satellites are particularly notable.<sup>3</sup>

In the decade since ODS, the value of space-based capabilities has grown significantly. Normalizing space by integrating space capabilities into routine operations has led to the delivery of expansive space-based products and services to warfighters. For example, Operation Noble Anvil in Kosovo used twice the bandwidth used during ODS. Operation Enduring Freedom (OEF) used 7 times the amount, and Operation Iraqi Freedom (OIF) used 42 times the amount.<sup>4</sup> In OEF and in the early phases of OIF, space-based assets gave U.S. and



U.S. Army

Members of an Army Space Support Team install satellite communications in support of Operation Iraqi Freedom.

Coalition forces robust, uninterrupted satellite communications (SATCOM); around-the-clock intelligence, surveillance, and reconnaissance (ISR); and near-real-time navigation and positioning data.

Today, space enables virtually everything we do, from missile early warning systems to command and control of military forces. Space extends the range and capabilities of communications, enhances situational awareness beyond terrestrial capabilities, and provides better intelligence for synchronized combat operations by enabling the collection of new types of data and information. Space support is particularly valuable in remote areas having austere or nonexistent communications infrastructures. Secretary of Defense Donald Rumsfeld recently noted: “Over the past few years we have recognized that space and information are not only enablers, but core warfighting competencies.”<sup>5</sup>

The U.S. Army Space and Missile Defense Command (USASMD) is the specified Army proponent for space. In addition to its Title 10 Army responsibilities, USASMD also serves as the Army Service Component Command (ASCC) to the U.S. Strategic Command (USSTRATCOM). As such, it is dual-titled as USASMD/Army Forces Strategic Command (ARSTRAT). USASMD/ARSTRAT’s 1st Space Brigade provides OIF/OEF combatant commanders with Soldiers, civilians,

equipment, and access to a variety of space-based products and services. The brigade’s three battalions (the 53d Signal Battalion [SATCOM], the 1st Space Battalion, and the 193d Space Support Battalion [Colorado Army National Guard]), headquartered in Colorado Springs, provide SATCOM and force-enhancement capabilities in support of combatant commanders.

During the early phases of OIF, six Army Space Support Teams (ARSSTs) supported the Coalition Force Land Component Commander, V Corps, 1st Marine Expeditionary Force, and the Office of the Coalition Provisional Authority by delivering space products, services, and expertise to joint warfighters. The ARSSTs were on-the-ground space experts, pulling down imagery and intelligence data, forecasting the effects of space weather on SATCOM, projecting the health of the GPS and other satellite constellations, and providing responsive space support to their units. Additional space-trained Soldiers and liaison officers supported the Joint Special Operations Task Forces North and West, the 4th Infantry Division (ID), and other deployed units.

The USASMD/ARSTRAT Operations Center in Colorado Springs maintained around-the-clock situational awareness of deployed elements, responded to hundreds of requests for information, and provided essential reachback connectivity



with technical subject matter experts. Regional SATCOM Support Centers and Defense Satellite Communications System Operations Centers in the United States and multiple overseas locations provided reliable, responsive SATCOM support. In addition to ensuring space-based force enhancement, USASMDC/ARSTRAT provided missile early warning and missile-defense support. The 1st Space Brigade's Theater Missile Warning Detachments, expertly manned by Army and Navy personnel, monitored enemy missile-launch activity and other infrared events of interest. Even today, an extensive array of space- and missile-defense resources, including forward-deployed Soldiers, civilians, and equipment, continue to support joint warfighters in Iraq and Afghanistan.

Space power is a decisive, asymmetrical advantage for our Nation, especially for U.S. military and intelligence activities. We can see and act quicker, and our responses to situations can occur more rapidly and decisively. However, maintaining U.S. dominance is difficult. Advanced technology is readily available through wide-spread proliferation, materiel acquisition, and purchase of technological services.

While the United States will continue to dominate space in the near future, other nations are no longer content to be

bystanders. Most adversaries study and understand U.S. capabilities and strive to adapt techniques to overcome their disadvantages. Technologies for sensors, information systems, wideband communications, imagery, precision guidance, and microsatellites are increasingly available. The global proliferation of commercial space systems makes available to adversaries products and services that rival ours. Once only accessible to technically advanced nations, wideband communications and high-resolution imagery are now available to most state and nonstate actors. Countries worldwide also continue vigorous space programs to obtain accurate imaging, precision navigation and timing, and near-instantaneous global communication. Nearly one-third of all Western satellites scheduled for launch in the near future are predicted to belong to countries other than the United States.<sup>6</sup>

The value of U.S. space assets has not escaped our adversaries' notice. Just as we have taken advantage of recent advances in technology, they have demonstrated the capability to use new, more lethal forms of technologies. Some adversaries—

current and potential—seek to acquire advanced capabilities to deny U.S. forces unimpeded access to operate through and from space. Nations have also used available technology to attempt to control and disrupt communication systems and other types of U.S. equipment.<sup>7</sup>

Protecting our assets, enabling our unfettered access to space, and denying our adversaries the benefits of this high ground are in our vital military interest. Space control, a mission all services share, ensures our freedom of action in space and, when directed, denies it to an adversary. Ensuring that all components (satellites, ground stations, data links between satellites and ground stations, and data links between satellites) are adequately protected is important to conducting net-centric operations and protecting national interests. Notably, actions are ongoing to develop Army contributions to the space surveillance and negation functions of space-control operations.

## Remaining Relevant and Ready

Technological and industrial dominance played prominent roles in U.S. military victories during

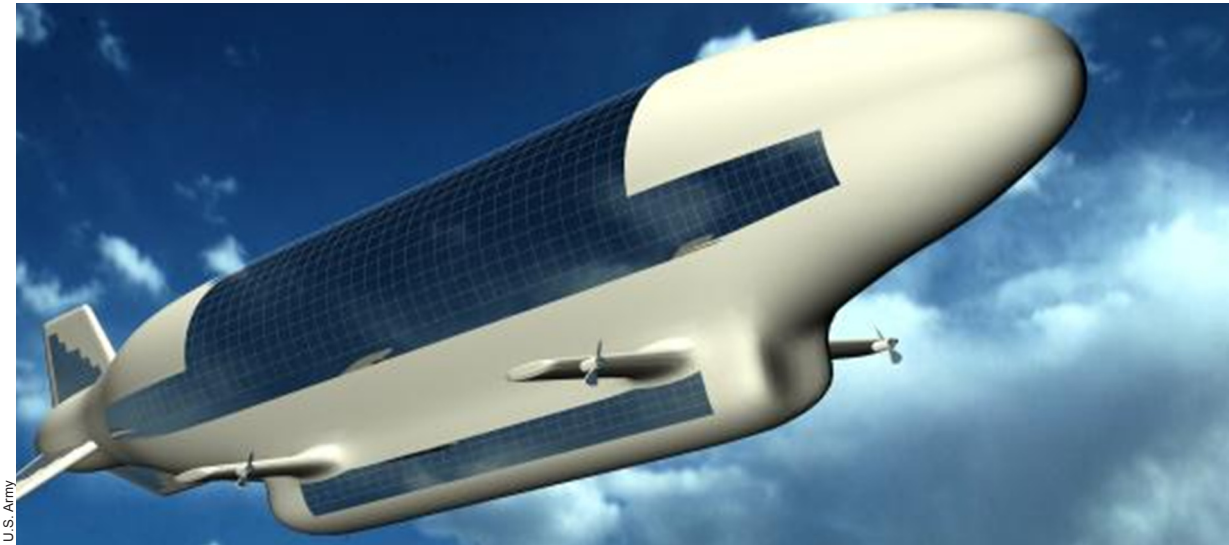
the past 60 years, and these areas are similarly instrumental for military forces involved with GWOT. Advances in technology and the

changing nature of the threat have made the use of space essential. Wideband SATCOM; position, navigation, and timing data; weather, terrain, and environmental data; and ISR and missile early warning data are now readily available to our military forces. For example, virtually all Soldiers now have ready access to systems supported by GPS or enhanced by space-based communications satellites.

Space-based products and services are now so embedded in military operations that their means of delivery are as transparent to their recipients as electricity. These same capabilities were instrumental in planning and providing humanitarian assistance and recovery operations for the hundreds of thousands of victims of the 2004 tsunami catastrophe in Southern Asia and the 2005 hurricanes in the United States.

Ongoing combat operations indicate that commanders yearn for timely, actionable intelligence to meet operational requirements and to support military decisionmaking. The challenge for today's commanders is to set their own critical

*Three timeless questions lie at the heart of warfighting information requirements: Where am I? Where is my buddy? Where is the enemy?*



**Space empowered: High Altitude Airship Advanced Concept and Technology Demonstration prototype.**

information requirements carefully to avoid being inundated with data. Commanders and Soldiers at all levels must have timely, accurate information on their locations, locations of their forces and other friendly forces, and enemy locations. Three timeless questions lie at the heart of warfighting information requirements: Where am I? Where is my buddy? Where is the enemy? Answering these questions provides enhanced situational awareness and knowledge of the environment, the enemy, and friendly forces.

The goal of situational awareness is to enable U.S. forces to communicate with each other; share information about their and the enemy's locations simultaneously; and see the same, precise, real-time picture of the battlespace. Former Army Chief of Staff General Gordon Sullivan is credited with saying: "Information is the currency of victory on the battlefield."<sup>8</sup> Situational awareness is particularly vital given the challenges of conducting operations in built-up areas, as is currently the case in Iraq. Buildings and other permanent structures block line-of-sight (LOS) communications and prevent Soldiers from seeing the enemy. The complex terrain of Afghanistan also complicates LOS communications and observations. The Army will continue to confront similar terrain in the future. Space-based assets help deliver capabilities that are otherwise constrained by LOS limitations.

The technology that gained the most recognition for contributing to situational awareness during the initial phases of OIF was Blue Force Tracking (BFT). Although BFT received public accolades for its use during military operations (including the capture of Saddam Hussein in December 2003), its

real worth proved to be its effectiveness in helping to prevent fratricide at the tactical and individual Soldier level.<sup>9</sup> Establishing the capability, however, was not a simple task. By one count, more than 60 different BFT systems were employed during the initial combat phases of OIF.<sup>10</sup> Unfortunately, each system had separate hardware, software, and means of transmission ranging from unsecure LOS to encrypted SATCOM. Grenadier Beyond LOS Reporting and Tracking and the minitransmitter used the COBRA waveform signal compatible with national space systems. The Force XXI Battle Command Brigade and Below used the commercial L-Band system. Our military forces also used several other systems. Despite the necessity for significant workarounds, BFT paid handsome dividends in combat identification, fratricide prevention, and friendly force tracking.

The Joint Mission Management Center (JMMC) for space-based BFT provides near-real-time Joint BFT data gathered by space-based systems. The JMMC is the critical link between warfighters, national agencies, and a variety of dissemination architectures. The Space and Missile Defense Battle Lab, which is part of the Space and Missile Defense Future Warfare Center, has made great progress integrating space-based and LOS BFT systems into a common operating picture, which is especially important until a common operating system is established.

Much has also been written about the contributions that unclassified commercial imagery provides to Coalition forces. In fact, more than 42,000 imagery products have been made available to joint planners and warfighters.<sup>11</sup> Imagery-based spectral products

help identify terrain hazards, conduct drop-zone analysis and route reconnaissance, and determine the locations of mass graves.

Imagery, and its timely delivery to those who request it, has improved substantially. During ODS, the resolution was approximately 10 meters (m), and requests often were not filled for days or weeks.<sup>12</sup> During OIF, USASMD/ARSTRAT's Spectral Operations Resource Center (Forward) was able to provide downlinked commercial imagery of approximately 1-m resolution in many cases within only a few hours of request.<sup>13</sup>

Formation of the new U.S. Strategic Command Measurement and Signatures Intelligence/Advanced Geospatial Intelligence (USSTRATCOM MASINT/AGI) Node in August 2005 builds on the capabilities of the SORC by providing expanded capabilities and tailored MASINT and AGI products to warfighters.

The demand for increased space-based spectral, radar, and commercial imagery will continue to accelerate as Army ground units are exposed to the capabilities that we can bring to the battlefield. Spectral and radar systems enable us to gain more information than simply "seeing the ground" and the use of commercial data improves our ability to share information across Coalition and nontraditional mission partners (a key tenet in our Nation's GWOT as well as Homeland Defense). The use and application of these space-based capabilities will continue to grow as small, tactical satellites are enhanced. As a result, Army forces will be able to apply increasingly responsive space-based support during combat operations.<sup>14</sup>

The necessity for relevant information and actionable intelligence also extends to missile early warning, an operational capability inextricably linked to space. In ODS, the missile early warning was developed quickly and based on existing architectures designed to counter the intercontinental ballistic missile and air-breathing threat. However, by the start of OIF, an integrated missile defense and warning system had been put in place to support joint warfighters. Space-based missile early warning, supported by Defense Support Program (DSP) satellites, Aegis cruisers, and Patriot radars, provided detection and warning of missile launches. All were linked by satellites. Contributing to the capability were the Theater Missile Warning Detachments, which received event data directly from DSP satellites. The detachments processed

the information in theater, then disseminated the information within minutes by data and voice to theater and worldwide users.

DSP satellite system capabilities are limited, particularly against cruise missiles and theater ballistic missiles that pose a threat to U.S. forces.<sup>15</sup> The Space-Based Infrared System (SBIRS) High will ultimately replace current DSP satellites and provide significant enhancements in the areas of missile early warning, missile defense, technical intelligence, and battlefield characterization. The SBIRS High will also detect and track shorter range missiles with greater accuracy.<sup>16</sup>

Ultimately, new hardware and software will upgrade the Joint Tactical Ground Stations to a Multi-Mission Mobile Processor (M3P) configuration. The M3P, a joint venture of the U.S. Air Force and the U.S. Army, will process both DSP and SBIRS satellite infrared data to provide improved ballistic early warning and battlespace characterizations to combatant commanders worldwide.

## Transformation: Requirements and Capabilities

As President George W. Bush noted: "[A] future force is defined less by size and more by mobility and swiftness[,] is easier to deploy and sustain [and] relies more heavily on stealth, precision weaponry and information technologies."<sup>17</sup>

The Army views space as a vertical extension of the battlefield and an integral part of the battlespace.<sup>18</sup> Space will empower Future Combat Force modular forces and routinely exploit "military and civilian space systems to support decision dominance and decisive victory."<sup>19</sup>

The Army's strategic role in space, although significant over the past 20 years, is but a glimpse of a future in which the Army, seamlessly integrated into the joint force, will exploit the "new high ground." The Future Combat Force will be the most technologically significant transformation in the Army's more than 230 years of history. TRADOC Pamphlet 525-3-0, *The Army in Joint Operations: The Army's Future Force Capstone Concept, 2015-2024*, notes: "As a space-empowered force, the Future [Combat] Force will routinely exploit the constellation of military and civilian platforms for persistent surveillance, reconnaissance, communications, early warning, positioning, timing, navigation, weather/environmental monitoring, missile defense, and access to the global information grid."<sup>20</sup>

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U.S. Army

**CPT Timothy Tubergen, LTC Eric Henderson, and MAJ Sandra Yanna, serving with Army Space Support Team 14, take a moment to relax during their deployment in Iraq, 2003.**

The Army's Current to Future Combat Force Strategy will provide tailorable units with improved deployability and increased lethality. These lighter, mobile, survivable modular formations will fight as self-contained units in nonlinear, noncontiguous battlespace; arrive at multiple austere points of entry via air and sealift; and possess off-the-ramp capabilities. The Future Combat Force will rapidly deploy formations to conduct entry and shaping operations to facilitate access by other forces, engage enemy forces, and establish the conditions for success by direct attack of the enemy's decisive points and centers of gravity. The focus of warfighting will evolve to one where effects-oriented operations enable the creation of overmatching synchronized combat power against the enemy. The new concept will exploit superior knowledge of the battlefield, the enemy, and friendly forces to wage attacks against the enemy in near-simultaneous fashion. Space-based capabilities are essential to this concept.<sup>21</sup>

As a space-empowered and enabled force, the Future Combat Force will routinely exploit the overhead constellation of national, commercial, and military space platforms. The Internet-based Global Information Grid, a state-of-the-art global communications network designed to provide real-time information to joint warfighters, will provide intelligence; focused surveillance; area

reconnaissance; long-haul communications; missile early warning; positioning, navigation, and timing; and weather, terrain, and environmental monitoring. Layered robustness and improved capabilities provided by space-based assets contribute to an off-the-ramp situational understanding critical to theater entry operations and vital where the existing communications infrastructure is insufficient or unreliable. Support of the Future Combat Force expanded bandwidth availability from a network of satellite systems, which includes the Mobile User Objective System (MOUS), Wideband Gapfiller Satellites, Advanced Expanded High Frequency Satellites, and the Transformational Communications Satellite constellation. To mitigate shortfalls in the Military Satellite Communications capabilities, we will continue to augment our bandwidth requirements through commercial SATCOM.

One step to operationalize space in the Future Combat Force, as part of the Army's Current to Future Combat Force Strategy, is the establishment of an organic Space Support Element (SSE) in each of the Army Modular Forces headquarters. This action furthers the Army's integration of space capabilities and operations into planning, exercises, training, and all phases of combat operations. The first SSE, with the 3d ID, was certified in September 2004 and deployed with the unit to Iraq in January

2005. As of Fall 2005, five active SSEs have been activated and manned (3d ID, 10th Mountain Division, 101st Airborne Division (Air Assault), 4th ID, and 1st Cavalry Division) and one fires brigade in the 4th ID has been activated. Additional SSEs are scheduled for establishment in the coming years.

The SSE is the focal point for planning and integrating space-related capabilities in support of divisions and corps, tactical requirements in conjunction with joint, interagency, and multinational organizations and nongovernmental organizations across the full spectrum of operations. Functional Area (FA) 40 (Space Operations officers) and Military Occupational Specialty 25S (SATCOM operator/maintainers) noncommissioned officers (NCOs) provide organic space expertise in deliberate and crisis-action planning, theater exercises, operations, and support to the theater engagement strategy. Additional ARSSTs assigned to the 1st Space Brigade augment SSEs and units without organic SSEs to support planning and provide products and services for high-tempo operations. Each SSE and ARSST will be equipped with the Space Support Enhancement Toolset (SSET), a technologically advanced system that provides the tools and software for reachback, space analysis, and a limited capability to produce space-related products.

## Space, Missile Defense, and Technology

Rumsfeld said: "One thing we have learned in the Global War on Terrorism is that, in the 21st century, what is critical to success in military conflict is not necessarily mass as much as it is capability."<sup>22</sup> Success is now achieved through the capabilities provided by space-based products and services inextricably linked to missile defense. Leveraging the extraordinary potential of space requires a robust, capable missile-defense capability supported by information technology to protect it.

As the Army's proponent for space and integrated missile defense, USASMDC/ARSTRAT, in support of its Army Title 10 responsibilities, works closely with combatant commands to identify operational requirements. For areas requiring possible materiel solutions, USASMDC/ARSTRAT research, development, and acquisition (RDA) activities develop technologies and systems for detailed testing and evaluation. Other USASMDC/ARSTRAT

activities, including the USASMDC Future Warfare Center and the Ballistic Missile Defense System Manager, ensure synchronization of concepts, doctrine, training, and user requirements.

We expeditiously develop and field technological solutions to help combatant commanders address operational requirements. USASMDC/ARSTRAT's RDA activities support the Army's rapid fielding initiative that works to fast-track capabilities for the Future Combat Force and deliver them to forces in Iraq and Afghanistan. Surveillance of potential suicide bombers, target acquisition, detection of improvised explosive devices (IEDs), and BFT are of increased importance in Afghanistan and Iraq. Tremendous effort is ongoing within USASMDC/ARSTRAT RDA activities to develop capabilities to mitigate the deadly consequences of the indiscriminate use of IEDs and provide our warfighters actionable information on the locations of insurgents' gunfire. These initiatives include the Overwatch Advanced Concept Technology Demonstration (ACTD).

Concurrent with our responsibilities to the Current Force, USASMDC/ARSTRAT provides extensive operational

and technological support of the Current to Future Combat Force Strategy. Technologies that show great promise include those that contribute to persistent surveillance, expansive increases in bandwidth, and missile defense. Significant work is also ongoing in developing a single integrated space picture—a capability key to collecting and disseminating data for space situational awareness.

While space products and services derived from technologies beyond the Future Combat Force are not certain, we can foresee capabilities that will enable the space-empowered Future Combat Force to deliver precise effects—from taking imagery to dropping precision munitions—at any time and location. Direct tasking of satellites and dynamic retasking will also be possible by theater forces. Eventually, software programs embedded in military equipment at much lower user levels, much like GPS receivers today, will replace space-related intelligence, communications, and early warning ground stations. Network-enabled Soldiers will request data from space-based platforms, and self-determined parameters will allow Soldiers to select only the data they need. Warfighters will be able to change the parameters as their requirements change. As space technologies evolve, other capabilities,

*As space technologies evolve, other capabilities, including global missile defense, might emerge to provide a wide range of enhancements for effective warfighting.*

including global missile defense, might emerge to provide a wide range of enhancements for effective warfighting.<sup>23</sup>

## The Army's New Strategic Role in Space

Significant organizational changes have occurred as the Army's—and the Nation's—view of space has evolved. In 2001, the Commission to Assess U.S. National Security Space Management and Organization (the Space Commission) recommended changes in the U.S. Department of Defense. Rumsfeld subsequently directed organizational changes involving the former USSTRATCOM and U.S. Space Command that have led to consolidation and streamlining of space operations.<sup>24</sup>

The Space Commission also emphasized the need to develop a cadre of well-trained space professionals to encourage innovation and proper management of space systems. Also, the Commission recommended the military departments enhance space professional military education at all levels to integrate space activities into all military operations.<sup>25</sup>

The Army had already recognized the value of a cadre of space-qualified officers with the Officer Personnel Management System XXI, which established the FA40 career field in December 1997. Implicit in this action is the Army's realization that an understanding of space systems and capabilities is becoming an increasingly important part of the professional Soldier's skill set. The concept of a professional space cadre complements the actions of signal, intelligence, information operations, and engineer staff officers.

USASMDC/ARSTRAT is the Army's personnel proponent for FA40 officers. To date, more than 150 Army officers have been designated as space operations officers, including 5 Army astronauts serving with NASA. A robust space professional military education program has also been incorporated into all Army service school curricula, providing a relevant, fundamental level of space knowledge to officers, NCOs, Soldiers, and civilians. As a result, Soldiers are increasingly knowledgeable, skilled, and confident when working with space systems and products. Establishing FA40 and the new SSEs, creating the Army's space cadre, conducting a Space Operations Officer Qualification Course, and training and deploying ARSSTs and SSEs are recognition of the importance of space to Army warfighting.

On 1 October 2002, USASMDC/ARSTRAT was designated as the ASCC to USSTRATCOM, with responsibility for conducting space operations and providing planning, integration, control, and coordination of Army forces and capabilities in support of USSTRATCOM missions—global strike; space; integrated missile defense; information operations; and command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR). Each of these missions depends heavily on space-based products and services. The Army Campaign Plan designated USASMDC/ARSTRAT as the proponent for space and missile defense in the Army.

USASMDC/ARSTRAT's designation as the ASCC to USSTRATCOM (and the more recent designation of the commanding general as the commander of the Joint Functional Component Command for Integrated Missile Defense), and its designation as the Army proponent for space and missile defense provides an opportunity to synchronize Army and USSTRATCOM efforts across multiple mission areas. USASMDC/ARSTRAT is reviewing myriad issues to achieve this unity of effort.

Synchronizing the space mission areas of force enhancement, force application, space control, and space support are integral to the process. We are also working closely with our service counterparts to assure Army operational requirements receive support and integration.

## The Unfolding Future

The Army is in the midst of the most significant changes since World War II—changes that affect the way we think about, prepare for, and conduct war. Combat operations are no longer limited to land, sea, and air. They now include space and cyberspace. What we are witnessing is a paradigm shift, and this swift pace of change is in great part because of the extraordinary capabilities space-based products and services provide. The U.S. Commission on National Security/21st Century's Phase III Report emphasizes that "[t]he military cannot undertake any major operation, anywhere in the world, without relying on systems in space."<sup>26</sup>

The Army considers space an essential element of joint warfighting and, as such, vital to the Future Combat Force. The next several years will be exciting. The Army will field key Future Combat Force capabilities and technologies to enhance the effectiveness of the Current Force and joint forces engaged in the GWOT. We will see continued linkage between space and missile defense, both of which are vital to the Army and to the security of our Nation. *Secure the high ground! MR*



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*Lieutenant General Larry J. Dodgen, U.S. Army, is the Commanding General, U.S. Army Space and Missile Defense Command/ U.S. Army Forces Strategic Command, Arlington, Virginia. In January 2005 he became the Commander of the Joint Functional Component Command for Integrated Missile Defense. He received a B.S. from Louisiana State University, an M.B.A. from the University of Missouri, an M.A. from the U.S. Naval War College, and is a graduate of the U.S. Army Command and General Staff College. He has served in various command and staff positions in the continental United States, Korea, Saudi Arabia, and Germany.*